Associations between Chronotype, Blue-Light Emitting Media Use, and Sleep in Adolescents

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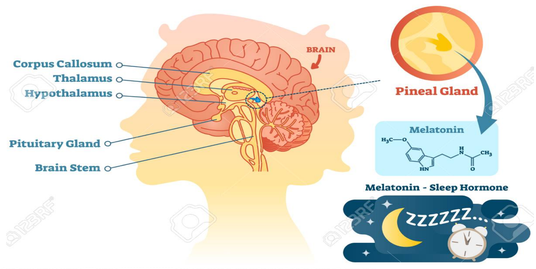
Introduction

Many adolescents are chronically sleep deprived[1] due to biological delays in sleep that occur with the onset of puberty[2]. This deprivation heightens risk for psychiatric symptoms, cognitive deficits, and lower academic functioning. Recent rises in electronic media use increases blue wavelength light exposure, which may contribute to sleep deprivation through suppressing melatonin release, further delaying sleep. This study investigated the influence of blue light exposure one hour before bedtime on the relationship between circadian preference (i.e., chronotype) and sleep outcomes.



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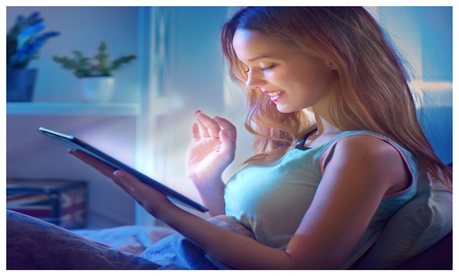

https://www.rebuildyourvision.com/wp-content/uploads/2017/05/Experts-are-Saying-Blue-Light-Blocking-Glasses-Don%E2%80%99t-Work.jpg

Methods

Participants

- 52 adolescents (61.5% female) aged 13-17 years (*M*=15.15, *SD*=1.23)
- Race: 55.8% Caucasian, 23.1% Asian, 9.6% African American, 5.8% Biracial, 3.8% Missing, 1.9% Native American
- Ethnicity: 30.8% Hispanic
- Participation Time: 64.3% participated during school holidays
- All participants had no known or suspected sleep disorders, were not receiving treatment for any psychiatric disorders, and had access to a smart phone
- Participant data collected from overarching study examining the general relationship between emotion and sleep in adolescents

Measures

- Actigraphy data collected continuously over 7-11 days (Median = 8 days) using Philips Spectrum Plus Actiwatch
- Mean exposure of blue wavelength light one hour before bedtime across the week assessed through light monitor on Philips Spectrum Plus Actiwatch
- Chronotype assessed using the 10-item Morningness-Eveningness Scale for Children[3]
- Pubertal status assessed using the 5-item Pubertal Development Scale[4]
- Mean Sleep Onset Time (SOT), Sleep Onset Latency (SOL), Total Sleep Time (TST), and Wake after Sleep Onset (WASO) across the week

Procedures

Baseline: Self-report measures (including chronotype)

→ Actigraphy (7-11 Days)

→ **2nd Visit:** Behavioral assessment and self-report (including puberty scale)

Results

- Mean total sleep time of all participants across the week (6.95 ±.83 hours) was less than the recommended sleep time for adolescents (8-10 hours) according to the American Academy of Pediatrics[5].
- When controlling for pubertal status and participation time (school year vs. school holidays), a greater preference for eveningness predicted a later SOT (Adjusted R^2 = .53, p < .001) but not SOL, TST, or WASO.
- All participants had at least some exposure to blue light within the one hour prior to bedtime (*M* = 7.18 flux, *SD* = 6.45).
- Blue light exposure did not moderate the relationship between chronotype and sleep outcomes.

	SOT (*M*=12:21AM, *SD*=88minutes)			**SOL** (*M*=14.04, *SD*=9.42)			**TST** (*M*=417.01, *SD*=49.61)			**WASO** (*M*=38.39, *SD*=12.89)		
	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI	B	SE	95% CI
Chronotype (M=27.08, *SD*=3.62)	-812.62**	229.34	-1276.14, -349.10	1.05	.79	-.61, 2.71	-2.84	2.91	-8.71, 3.04	1.10	23.52	-18.72, 76.34
Blue Light	111.75	749.56	-1403.18, 1626.67	.64	2.43	-4.50, 5.78	-10.33	9.50	-29.54, 8.87	-.65	2.48	-5.66, 4.36
Participation Time	2042.66+	1178.92	-340.06, 4425.38	2.07	4.78	-8.02, 12.15	43.36*	14.95	13.16, 73.57	4.21	3.90	-3.67, 12.1
Puberty	1789.22*	698 .07	378.35, 3200.08	-3.75	2.59	-9.22, 1.72	-4.42	8.85	-22.30, 13.47	-4.82*	2.31	-9.49, -.15
Chronotype* Blue Light	-5.35	26.58	-59.07, 48.36	-.02	.09	-.21, .17	.41	.34	-.27, 1.09	.00	.09	-.17, .18

Notes. All analyses controlled for pubertal status and timing of participation (i.e., during the school year vs. school holidays). SOT = Sleep Onset Time, SOL = Sleep Onset Latency, TST = Total Sleep Time (in minutes), WASO = Wake after Sleep Onset, Chronotype = Preference for staying up late (eveningness) vs. waking up early (morningness), Blue Light = Mean exposure to blue light during the one hour before bedtime over the week. *p<0.05, **p<0.01, +p<0.1

Conclusions

- The adolescents in this study experienced inadequate sleep.
- These findings suggest that although adolescents are exposed to blue light before bedtime, biologically determined chronotype influences sleep outcomes regardless of their blue light exposure before bed.
- Sleep interventions focusing on structural (e.g., adjusting school start times) rather than behavioral (e.g., limiting media use) changes may be more beneficial in improving sleep outcomes for this population.

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http://www.ssp.df.gob.mx/development/assets/images/img/coste/bcel.png

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